#1243

1243

United States

Department of Agriculture

Forest Service

Cooperative State

Research Service

Agriculture

Handbook No. 624

Spruce Budworms Handbook

Ground-Spray Techniques

To Reduce Damage From

Western Spruce Budworm

Ground-Spray Techniques To Reduce Damage From Western Spruce Budworm

by L. E. Stipe[1]

Introduction

The western spruce budworm has an annual life cycle of four stages--egg, larva, pupa, and adult (moths). The stages, damage caused by budworm, and host species are described and illustrated by Fellin and Dewey (1982).

Ground sprays will reduce current defoliation and cone damage by budworm larvae and help maintain tree vigor, thus minimizing permanent damage to trees. The strategy is to time the application of the control agent for maximum kill of the insect pest with the least effect on the environment. Cone and seed protection using ground applications has increased Douglas-fir seed yields by nearly 50 percent. Further tests are needed to determine the value of this technique on other species (Stipe and Green 1981). Equipment operated at ground level is used to apply the spray mixture to the foliage when insect larvae are actively searching and feeding. Control during other life stages (for example, moths) is not recommended.

Insecticides, Mixing, and Safety Precautions

Although several pesticides are registered by the U.S. Environmental Protection Agency for control of western spruce budworm, only two

---

[1]Entomologist, U.S. Department of Agriculture, Forest Service, Northern Region, Cooperative Forestry and Pest Management, P.O. Box 7669, Missoula, MT 59807.

chemicals and one microbial insecticide are discussed here. Acephate and carbaryl are generally considered the most effective chemical pesticides for budworm control. Both are available at most retail outlets that handle spray materials. Acephate (Orthene Forest Spray)[2] is an organophosphate insecticide that remains active for about 10 days. It is primarily a contact and stomach poison with limited, residual systemic action. The water-soluble powder formulation (75-percent active ingredient) is mixed at 1/2 pound/100 gallons (600 g/1000 l) of water.

Carbaryl (Sevimol 4), widely used in agriculture and forestry, is a carbamate insecticide that lasts about 14 days. Sevimol 4 is a molasses formulation of carbaryl at 4 lb (1.81 kg) of active ingredient per gallon (3.785 l). It is mixed 1 quart of Sevimol 4 per 100 gallons (2.5 l/1000 l) of water.

Bacillus thuringiensis (Berliner) (Dipel, Thuricide, and Bactospeine) (B.t.) is a naturally occurring bacterium that provides the active ingredient in several commercial formulations of nonchemical insecticides. B.t., which is toxic to larvae of many foliage-feeding moths and butterflies, is effective

---

[2]The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others that may be suitable.

against western spruce budworm when mixed at the rate of 16 BIU[3]/100 gallons (378.5 l) water for application with high-volume spray equipment. B.t. products are nontoxic to mammals, birds, fish, and humans.

Use extreme caution with open containers of chemical insecticides. Wear proper protective equipment. To minimize handling, mix the formulation in the equipment holding tank. Verify tank calibration markings before use. Measure water as it is added, especially when preparing less than a full load. Begin agitation and add the proper amount of concentrated insecticide to the water. If the equipment does not have continuous mechanical agitation, stop and remix by hand frequently during application.

Selecting Spray Equipment

Selection of spray equipment depends on the number of trees to be treated and their height. Use a large tank to save mixing time when many trees are to be sprayed. For tall trees, use a high-pressure, orchard-type unit; the insecticide must be applied to all the foliage. If trees are

---

[3]BIU = international unit of potency of a preparation of Bacillus thuringiensis with reference to an international standard (HD-1 or E-61). The potency of the standard was assigned a value of 1,000 international units per milligram. For field use, the units are expressed in billions (BIU's).

small, a hand-operated, compressed-air sprayer can be used; garden-hose siphon types are not recommended.

Because most cone crops are concentrated in the upper crown, hydraulic equipment is needed. Gas-powered hydraulic pump sprayers are probably best. They have large tanks and, when operated at 400 lb/in^2 (27.2 atm), can reach over 50 ft (15.2 m) high.

Timing and Application

Select the application schedule according to your objectives.

To protect foliage: Spray when bud caps have fallen as the shoot expands to at least an inch (2.54 cm) long (fig. 1, top right). Late treatment--after larvae have consumed considerable foliage--provides little foliage protection (fig. 1, bottom). Early treatment--before shoot elongation (fig. 1, top left)--will not reach the larvae concealed in the young shoots.

To protect cones and seeds: Apply chemical pesticides much earlier than for foliage protection. Seed cone buds burst several weeks before the vegetative buds. Two applications are required. Time the first application to coincide with the start of spring larval dispersal. This normally occurs just as the female cones begin to elongate and before pollination is complete (cones are about 1 inch (2.54 cm) long). Spray again in about 14 days. Two treatments will provide about 30 days of protection during the initial dispersal period. Unless the trees are

attacked by other insects, two treatments should reduce damage throughout the budworm feeding period. B.t. is not recommended for seed and cone protection.

Spray the entire tree until the pesticide begins to drip from the needles (about 4 to 6 gallons [15.1 l to 22.7 l] per tree). Apply only when the foliage is dry, windspeed is under 6 mi/h (9.65 km/h), and rain is not likely within 12 hours after spraying carbaryl and acephate and 24 hours for B.t.